PROFILE OF

LAWRENCE LIVERMORE NATIONAL LABORATORY

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Office of Oversight
Environment, Safety and Health
Department of Energy

FOREWORD

Site profiles provide senior Office of Environment, Safety and Health managers with relevant and current site environment, safety, and health performance information as well as communicating to Department of Energy line management the Office of Oversight's concerns and understanding of site conditions. Site profiles are a key management tool used by the Office of Oversight to focus and prioritize independent oversight evaluation activities and to optimize the allocation of Oversight resources. The Office of Oversight maintains site profiles on 20 major Department of Energy sites, and normally updates each profile semiannually through a process of soliciting Department of Energy line management review and comment on the revised site profile information. Upon resolution of any line management comments, the profile is considered validated and is disseminated.

Site profiles are developed using an institutionalized process of collecting data from multiple sources, and then collating, synthesizing, and analyzing this information to develop a balanced evaluation of environment, safety, and health performance at the site. The data that forms the basis of a site profile comes from sources both internal and external to the Department of Energy. Office of Oversight appraisal activities provide an important source of data. Data is also collected and synthesized from such sources as the Defense Nuclear Facilities Safety Board, the General Accounting Office, state regulators, and Department of Energy line management organizations. This information is reported in a format designed to highlight essential missions, performance, significant issues, and operational data at a management level. The process involves additional field verification of initial conclusions to confirm the validity and significance of the information. All Oversight offices participate in the collection, analysis, interpretation, and validation of site profile information.

As the site profile process matures, the Office of Oversight plans to incorporate additional information into the documents, including a presentation of quantitative measures and trends in environment, safety, and health performance, and a description of safeguards and security activities, performance, and issues.

PROFILE OF

LAWRENCE LIVERMORE NATIONAL LABORATORY

OVERVIEW

SITE CHARACTERISTICS

Site characteristics include information on site size and location, mission, organizations, contractual status, and major initiatives and activities.

Additional information on site characteristics is provided in Section 1.0, starting on page 1.

Date Established: 1952

Present Mission:

Primary - Research, development, and maintenance of nuclear weapon designs.

Secondary - Strategic defense, energy, environment, biomedicine, and education.

Size: Lawrence Livermore National Laboratory (LLNL)--821 acres (1.3 square miles); Site 300--7000 acres (11 square miles). LLNL has about 600 buildings; of these, 260 facilities involve hazards other than those found in typical office buildings; of the 260, eight are considered non-reactor nuclear facilities and 63 as radiological facilities.

Employees: Approximately 7,265 Department of Energy (DOE) funded University of California full-time equivalents (as of March 1996). OAK has 140 employees.

Annual Budget: The fiscal year 1996 operating budget is $875 million and the capital budget is $152 million.

Cognizant Secretarial Office: Assistant Secretary for Defense Programs (DP). Principal offices include DP-13 and DP-20. Energy Research (ER-20). Environmental Management (EM-20, EM-30 and EM-44) and Nuclear Energy (NE) also have interests at LLNL.

Responsible Operations/Area Office: DOE Oakland Operations Office (OAK)

On May 15, 1996, the Secretary of Energy announced plans to extend the LLNL contract.

Contractor:
University of California

Major Subcontractors:

Stone and Webster
KMI
Waltrip
Jobs Plus
RRA.Inc
Allied Signal

Fissile Material: Approximately 0.3 metric tons as of February 6, 1996.

Significant Commitments to Stakeholders: Triparty Management Agreement November 1992 with DP, ER, and NE describing roles and responsibilities. (Note: this agreement is out of date.)

LLNL has an active program to involve the community in their ground water clean-up efforts at both the Livermore site and Site 300. They actively work with Technical Assistance Grant recipients at each site, publish an environmental community letter, have a Community Review Panel for all public information materials for Site 300's environmental restoration and host a quarterly working group meeting for the Livermore site.

Unions: Protective Service Officers Association (PSOA), approximately 132 Officers. Other organizations, such as the Woman's Association and the Society of Professional Scientists and Engineers (SPSE), are actively involved in presenting employee issues to management.

Major Site Activities/Initiatives:

Additional information on major site activities is provided in Section 1.4, starting on page 2.

Decontamination and decommissioning (D&D) is projected for buildings 251, 222, and 412 but specific dates and plans have not yet been developed.

The Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) facility is being turned over to the United States Enrichment Corporation (USEC).

Work has begun on the advanced conceptual design for the National Ignition Facility. Construction of this billion dollar facility should begin in 1997 and be completed by 2002.

A Contained Firing Facility, at Site 300, is currently in the conceptual design phase.

ENVIRONMENT, SAFETY, AND HEALTH (ES&H) ISSUES

Additional information on sitewide issues is provided in Section 3.0,

A sitewide issue is an issue present at multiple facilities or within

ES&H programs that impact sitewide operations.

starting on page 5.

Sitewide Issue 1: Workers are potentially at risk of exposure to plutonium due to vulnerabilities associated with material packaging, facility conditions, and excess inventory.

Sitewide Issue 2: DOE line management has been less than fully effective due to a lack of coordination among site programs. This led to a November 1995 reorganization intended to focus ES&H expertise and improve the Facility Representative program.

Sitewide Issue 3: Authorization basis documents are not complete and safety envelopes are not always maintained.

Sitewide Issue 4: LLNL's matrix management style has resulted in significant benefit, however, some instances of poor implementation have reduced safety margins.

Sitewide Issue 5: Construction of a planned explosive waste treatment facility has been inordinately delayed due to the state permitting process.

Sitewide Issue 6: Deteriorating facilities reduce the margin of safety afforded workers.

KEY FACILITIES

A key facility is a facility or building that is significant from an environment, safety, and health perspective. At some sites, a key facility can be a group of facilities with similar missions, activities, hazard or vulnerabilities.

Additional information on key facilities is provided in Section 4.0, starting on page 9.

There are 15 key facilities at LLNL.

Site 300 Environmental Testing Facilities - These facilities support safety performance testing and high explosives characterization.

Site 300 Chemical Processing Facilities - These facilities consist of laboratories for processing energetic materials and components.

Heavy Element Facility, Building 251 - This facility contains offices, laboratories, and equipment (including glove boxes) associated with heavy element research.

Chemistry Facility Building 132 N - Building 132N is a new chemistry facility that is being constructed to replace Building 222.

Building 166 - This non-nuclear facility is used for general research.

Superblock, Buildings 331, 332, and 334 - The Superblock area is a special-access area provided constant protection.

321 Complex - Most of the 321 Complex was built in the late 1950s and supports general site machining requirements.

Site 300 Mechanical Processing Facilities - Site 300 mechanical processing facilities prepare explosive test assemblies.

Site 300 Firing Facilities - The Site 300 Firing Facilities are used for "hydrodynamic testing" of HE.

Site 300 Materials Management Facilities - The materials management facilities have overall control of receiving, shipping, storage, and accountability of high explosives (HE).

Superblock Support Facilities - Buildings 231 and 233 contain vaults that store plutonium sources (among other things).

Chemistry and Material Science Facilities - The chemistry and materials science facilities (Buildings 222, 151, 235, 241) at LLNL are engaged in a wide range of research and development projects.

High Explosives Applications Facility (Building 191) - The High Explosives Activities Center (HEAF) has its own machine and electronics shops and a variety of laboratories for synthesis, formulation, and small-scale sensitivity and safety testing of experimental energetic materials.

Uranium-Atomic Vapor Laser Isotope Separation (U-AVLIS) Facility - Building 490, built in the mid-1980s, is the primary Uranium-Atomic Vapor Laser Isotope Separation (U-AVLIS) facility.

Waste Management Facilities - The 514 Area, 612 Complex and Building 693 are used for waste management activities.

SITE PERFORMANCE

Site performance is based on an analysis of available data on facilities and programs. This includes information from Office of Oversight activities, augmented by valid and relevant external and internal sources. Site performance is evaluated in terms of three of the guiding principles for safety management.

Additional information on site performance is provided in Section 2.0, starting on page 2.

Overall Safety Management Program - NOT EVALUATED

Principle #1 - Line Management Responsibility - NOT EVALUATED

LLNL line management has accepted responsibility and accountability for safety. Occasional, implementation of the matrix management approach has not been fully effective.

Implementation weaknesses were noted in maintenance, corrective

actions, occurrence reporting, hazard analysis, chemical safety, electrical safety, and authorization basis.

OAK Oakland line management responsibility and accountability has been fragmented in recent years.

Principle #2 - Comprehensive Requirements - NOT EVALUATED

Generally, effective systems have been created to establish and implement clear requirements. However, these requirements are not always understood, implemented, or kept current.

Programs hampered by comprehensive requirement weaknesses include electrical safety, chemical safety, project work plans, occurrence reporting, and maintenance of safety margins at nuclear facilities.

Principle #3 - Competence of Personnel - NOT EVALUATED

OAK has the experience and resources necessary to evaluate contractor performance.

LLNL's professional competence level is exceptional .

PERFORMANCE MEASURES

Performance measures are quantitative and qualitative indications of ES&H performance taken from such sources as the Occurrence Reporting and Processing System and the Computerized Accident/Incident Reporting System, as well as contractually mandated indicators of performance.

To be provided in future versions of the site profile.

Additional information on performance measures will be provided in Section 5.0 of future versions of the site profile.

Figure 1. LLNL Site Map

SITE PROFILE -- LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)

1.0 SITE CHARACTERISTICS

1.1 SITE LOCATION AND SIZE

The LLNL site, located in Livermore, California, approximately 40 miles east of San Francisco, encompasses 821 acres (1.3 square miles). LLNL Site 300 occupies approximately 7,000 acres (11 square miles) and is located about 15 miles east of the LLNL site. The site has about 600 buildings including 260 facilities with hazards greater than those found in office buildings. Eight of the 260 facilities are characterized as non-reactor nuclear and 63 as radiological facilities.

1.2 SITE MISSION

LLNL was created in 1952 to serve as a second laboratory dedicated to research, development, and maintenance of nuclear weapon designs. Over the years, the mission has been broadened to include strategic defense, energy, the environment, biomedicine, the economy, and education.

Site 300 was established in 1953 as a high explosives test site to support LLNL nuclear weapons development. The mission at Site 300 also includes increasing explosives research, development and testing for conventional weapons as well as other non-explosives research in areas such as lasers and electromagnetic wave behavior.

1.3 SITE ORGANIZATIONS AND CONTRACT STATUS

Site Organizations

Activities at LLNL are managed by the Department of Energy (DOE) Oakland Operations Office (OAK.). The University of California has been operating LLNL since the Laboratory's inception in 1952; the current contract is scheduled to expire in November 1997. LLNL's annual operating budget is approximately $875 million. The fiscal year 1996 capital budget was $152 million. The DOE funded staff (as of March 1996) numbered 7,265 of the approximately 8,000 employees on site. About 36 percent of the employees are scientists or engineers, 14 percent are managers or administrators, and nearly 50 percent are technicians or other support personnel.

LLNL established its indirect environment, safety, and health (ES&H) costs for fiscal year 1996 at $49.2 million and 435 full-time equivalents.

Major subcontractors at the site include Waltrip, mechanical services; Stone and Webster, minor construction services; RRA Inc. , drafting services; Allied Signal, professional support; and KMI and Jobs Plus, administrative and specialty support. The number of subcontractors is estimated at 810 full-time equivalents.

Contract Status

On May 15, 1996, the Secretary of Energy announced plans to seek a five-year extension of the contract with the University of California to maintain and operate LLNL. As a condition of the extension, the contract must embody the objectives of the contract reform initiative, including greater use of results-oriented performance and results-based payment.

Previously, on November 20, 1992, the Department had extended and revised its contract with the University of California through September 30, 1997. The contract (Contract No. W-7405-ENG-48) contained 22 ES&H Performance Objectives for fiscal year 1995. DOE evaluation of these performance measures for fiscal year 1995 resulted in a combined ES&H rating of 80.79% or

"Excellent." This rating, taken with that of others not in the ES&H area resulted in an overall rating of 88.86%, or "Excellent," for the University's management of LLNL. This overall all rating resuted in an Executive Merit Pool increase of 4.85% for the University executives managing LLNL.

1.4 MAJOR SITE INITIATIVES/ACTIVITIES

Decontamination and Decommissioning

Decontamination and decommissioning (D&D) is projected for Buildings 251, 222 and 412, but specific dates and plans have not yet been developed.

Privatization Activities

The Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) facility is being turned over to the United States Enrichment Corporation (USEC).

Programmatic Activities

Multiple studies are conducted involving characterization of ground water contamination from site operations. There is also a continuing epidemiology study investigating melanoma.

Work has begun on the advanced conceptual design for the National Ignition Facility. Construction of this billion dollar facility should begin in 1997 and be completed by 2002.

A Contained Firing Facility, at Site 300, is currently in the conceptual design phase.

Serious consideration is being given to reassignment of high explosive manufacturing from Pantex to LLNL and Los Alamos National Laboratory.

2.0 SITE PERFORMANCE

2.1 CONCEPTUAL BASIS FOR EVALUATION

The essential characteristic of successful programs and projects is the recognition and understanding of the need for an effective management system that ensures adequate control over all aspects of the program or project. In 1994, the Secretary of Energy forwarded to Congress and the Defense Nuclear Facilities Safety Board the principles and criteria that the Department deemed necessary for an effective safety management program. These principles include:

- Principle #1: Line managers are responsible and accountable for safety.
- Principle #2: Comprehensive requirements exist, are executed, and are appropriate.
- Principle #3: Competence is commensurate with responsibilities.

2.2 SAFETY MANAGEMENT PROGRAM IMPLEMENTATION OF THE GUIDING PRINCIPLES

This interim evaluation was developed using the results of surveillances performed by the Office of EH Residents and other Office of Oversight data sources. The absence of an independent oversight evaluation at LLNL suggests that the information presented should not necessarily be considered representative of overall ES&H performance across LLNL, but rather an indication of the

program or specific facility identified. Where sufficient information was not available to make a comprehensive assessment of either the implementation of a guiding principle (Section 2.2) or an implementing program (Section 2.3), a limited evaluation or specific example of performance based on the best available information is provided.

Principle #1 - Line Management Responsibility for Safety

A review of the 1995 surveillance reports, the 1994 Chemical Safety Vulnerability Working Group Report, and other Office of Oversight data sources suggests that line management has generally accepted responsibility for safety, with some notable weaknesses in management systems, defined responsibilities and authorities, and accountability for performance. Weaknesses noted include:

- Poor implementation of the LLNL matrix management system has contributed to miscommunication of ES&H responsibilities among directorates, less than full integration of sitewide ES&H programs, and lack of adequate controls and accountability for contractors. This situation has reduced the effectiveness of ES&H programs and reduced margins of safety established by the authorization basis (see Sitewide Issue 4).

- DOE management effectiveness has also been affected by one site hosting the programmatic interests of multiple program managers, especially within the area of documentation. Key management documents lack clear guidance for the implementation of DOE oversight. For example, the Triparty Management Agreement was to describe in detail the agreement and understandings of the assistant managers regarding their line management responsibilities for oversight. The document is out of date and has to some extent been superseded by the OAK reorganization of November 1995. (Sitewide Issue 2)

- The DOE Facility Representative program at LLNL has significantly improved as a result of the reorganization in November 1995. Previously, the program was not fully staffed: only one of seven Facility Representatives was qualified as of July 1995, and Facility Representatives had too many collateral duties competing for their attention. The reorganization reassigned the representatives, relieving all but one of their collateral responsibilities and moving several into their assigned facilities.

- Maintenance of older facilities has been hampered by funding and strategic planning associated with their future use, resulting in additional safety vulnerabilities and the exposure of workers to additional risks (see Sitewide Issue 6).

- Corrective action plans have not been fully developed for identified issues, and implementation of safety basis corrective actions has been slow.

Principle #2 - Comprehensive Requirements

Although LLNL has generally developed comprehensive requirements for most areas, surveillance reports indicate that requirements are not always well understood, implemented, or evaluated within the hazard analysis and occurrence reporting programs.

In the hazard analysis program, some authorization bases are not current, and safety envelopes are not always understood. For example, in the spring of 1995, Building 332 operations were placed in standby, because the facility had not completed required surveillances; Building 334 was not in compliance with its safety analysis report (SAR); and SARs have not been completed for all designated facilities as agreed to in response to the 1990 Tiger Team observations. (See Sitewide Issue 3.)

Implementation of the occurrence reporting program at LLNL is less than fully effective (See Facility Safety Program in Section 2.3).

Principle #3 - Competence Commensurate with Responsibilities

There were instances where the competence of the staff to perform important tasks or recognize potential workplace hazards was limited due to the lack of training. For example, some personnel had been tasked to perform work for which they were not qualified, and training was not scheduled as required to satisfy the tasking.

2.3 IMPLEMENTING PROGRAMS

Environmental Protection Program

Since 1994, LLNL has received consistently positive feedback from EH and regulatory agencies. After its 1994 appraisal, EH characterized LLNL's environmental program as "exemplary." During the same year the Environmental Protection Agency (EPA) conducted a comprehensive evaluation and issued no violations. In 1995, LLNL again received no violations after nine regulatory agencies conducted 31 inspections in all areas of environmental protection.

LLNL and OAK are making significant progress towards obtaining a permit for open burning and detonation at Site 300.

Nuclear Safety Program

The handling, storing, and controlling of radiological materials weaknesses outlined in Sitewide Issue 1 require improvement.

Worker Safety and Health Program

Deficiencies cited in chemical and electrical safety, hazard analysis, and training indicate that continuing management attention is needed to reduce unnecessary risks to workers. Although LLNL management was cited in 1994, during the Chemical Safety Review, as "having established systems that currently ensure the chemical safety of operations to an acceptable degree," the review identified four areas of concern: (1) strategic planning for disposition of aging and inactive facilities, (2) absence of emergency plan implementing instructions for an integrated LLNL response to a sitewide hazardous materials emergency, (3) weakness in the hazard analysis program, and (4) entry of personnel into potentially hazardous work environments without benefit of chemical safety training.

Strategic planning lacked explicit definition of the conditions under which the preparation of a project work plan is required to address new or modified operations involving the use of chemicals.

The effectiveness of hazard analyses is diminished by the lack of accident analyses in the facility safety documentation. An incident could result from the absence of an assessment of chemical safety problems that could be introduced by a new or modified process, or by failure to consider the risks of an unaddressed credible accident. More specifically, the work environment of some employees had not been evaluated to determine whether facility-specific chemical hazards training is warranted. As a result workers, could be exposed to chemical agents above acceptable concentrations (e.g., workers could unnecessarily or unknowingly expose themselves or coworkers to excessive levels of corrosive, reactive, carcinogenic, or toxic materials). The significance of this weakness is because the designation and understanding of safety training requirements, the emphasis on training, and the accuracy and retention of training records vary greatly among the organizations.

Seven commendable practices were also documented in the Chemical Safety review report. These included use of dedicated hazardous waste technicians, systems to calculate air emissions, forms to enhance identification of potential hazards in the work-place, independent safety committees, inventory tracking systems, support of the Toxic Materials Coordinating Committee, and coordination of LLNL's Fire Department response with that of other surrounding Departments.

On September 22, 1995, LLNL submitted its "LLNL Comprehensive Site Response Plan" to OAK. The Plan described and defended the adequacy of its existing programs. No specific corrective actions were presented in response to the eight "Generic Vulnerabilities." OAK reviewed LLNL's response/evaluation and did not require any action by LLNL. The OAK ES&H Oversight Pilot Programs conducted during November 1995 looked at hazard communication in the Chemistry and Material Sciences and Plant Engineering Directorates. They found no system to assure that paper files of Material Safety Data Sheets were kept current and also found some unmarked secondary containers in the Paint Shop.

EH-24 has not yet followed up to evaluate the veracity of LLNL's position that no action on its part was necessary in response to the Chemical Safety study. However, it should be noted that LLNL has several tiers of documents, ranging from "Emergency Response Guides" to Operational Safety Procedures, that specifically address actions to be taken in the event of a hazardous material problem.

Facility Safety Program

Weaknesses identified in maintenance, quality assurance, and occurrence reporting can increase risks to workers. The maintenance and quality assurance issues are discussed under Principle 1 and Sitewide Issue 6.

The report (*Independent Oversight Special Study of Occurrence Reporting Programs Within the Department of Energy*, November 1995 recorded several weaknesses at LLNL: (1) OAK had not conducted no formal appraisals by OAK addressing occurrence reporting implementation; (2) LLNL local implementing procedures had not been formally approved by the facility representatives or Cognizant Secretarial Offices as required; (3) LLNL procedures guiding Facility Representative verification reviews of occurrence report corrective actions and preparation of annual trend/generic cause root analysis reports are not being complied with; (4) large number of reports do not meet the timeliness requirement/goals specified in DOE Order 5000.3B; and (5) OAK has established multiple and inconsistent systems for accomplishing after-hours notification and response at the various sites it oversees. The multiple systems seem inefficient and could negatively impact event notification and response.

3.0 SITEWIDE ES&H ISSUES

3.1 ISSUE DESCRIPTIONS

Sitewide Issue 1: Plutonium Vulnerabilities

There is a potential for unplanned radiological exposure at LLNL due to vulnerabilities associated with material packaging, facility conditions, and excess inventory.

As of December 7, 1993, LLNL had 0.4 metric ton of plutonium left from previous research, development, and testing associated with nuclear weapons development. The plutonium is in the forms of metal, oxide, solution, scrap/residue, sealed sources, transuranic waste, holdup, and pits, and is stored in many different types of packages. Packaging materials include cans, plastic, foils, vessels, glass, drums, shipping containers, and ceramic.

Building 332 has 282 containers holding plutonium metal, oxide, and scrap/residues. The precise condition of the plutonium and its packaging is not completely known. Of these containers, 108 contain plutonium ash. In July 1994, LLNL discovered that eight can containers had bulged due to the presence of moisture.

Building 332 vaults contain approximately 140 kilograms of plutonium-bearing materials and 165 sealed sources of various types, both of which LLNL management considers excess to its mission.

The 1994 Plutonium Vulnerability Study identified 90 containers of unknown packaging

configurations in Building 251. Twenty of these contained isotopes of plutonium. The remaining containers held other transuranic elements. All material in the Building 251 storage vaults is packaged such that the outer package is a hermetically sealed metal container.

Building 231 has approximately 60 sealed sources with unknown packaging configurations. Degradation, damage, or rupture of any of these containers could spread plutonium and result in worker exposure. Some sealed sources, particularly older neutron sources, lack certification and quality assurance documentation or construction information (such as verification of double encapsulation). Sources that do not meet current American National Standards Institute standards may fail from pressurization due to helium gas buildup from plutonium decay.

Sitewide Issue 2: DOE Line Management Effectiveness

The effectiveness of DOE line management personnel on site at LLNL has, in the past, been limited by a lack of coordination among site programs and a lack of emphasis on the Facility Representative program. OAK has approximately 140 people on site at LLNL. Of these, 86 report to Defense Programs, while the others report to the Assistant Manager for Environmental Management and Support or the Assistant Manager for Energy Programs. The Assistant Manager for Defense Programs is also the designated DOE site manager at LLNL. These functions operate independently, resulting in a lack of coordination among onsite DOE personnel. For example, Building 132N will eventually fall under the purview of Defense Programs; however, the Defense Programs Facility Representatives are not involved in construction activities. Further, it was not clear which DOE organization has responsibility for ES&H reviews of construction activities at LLNL.

The DOE Livermore Site Office lacks a system to track ES&H commitments made to stakeholders such as the Defense Nuclear Facilities Safety Board.

The DOE Facility Representative program at LLNL had not received sufficient emphasis until the reorganization in November 1995.

Key management documents lack clear implementation guidance for OAK ES&H oversight. For example, the Triparty Management Agreement executed in November 1992 was to describe in detail the agreement and understandings among the assistant managers regarding their respective line management responsibilities for LLNL's ES&H oversight programs. This document fails to do so, resulting in confusion and poor coordination of OAK activities at LLNL.

In November 1995, OAK reorganized, to create a single DOE ES&H function and enhance the Facility Representative program. Under the new organization, the Assistant Manager for Defense Programs will no longer be the Site Manager. An Associate Manager for Site Management, located in Oakland, will be responsible for the new Livermore Site Management Division. An ES&H Coordinator position has been created, reporting to Livermore Site Management Division, with a charge to facilitate all site ES&H matters. The ES&H expertise previously assigned to the Livermore site office will remain on site, matrixed to the ES&H Coordinator.

Sitewide Issue 3: Authorization Basis/Safety Envelopes

In 1990, the Tiger Team observed that most facilities at LLNL did not have a safety basis. In response to the observation, the site agreed to complete SARs on designated facilities by October 1995. As of November 1995, four of the eight non-reactor nuclear facilities had a completed authorization basis for their present configuration; two other SARs were previously approved but no longer reflect the facility condition and are being revised. As of May 1996, two SARs are in draft, and two have been submitted to DOE for approval.

Even in buildings with completed SARs, the concept of safety envelopes has not always been fully understood and implemented at LLNL. For example, Building 332 operations were suspended in the spring of 1995 because the facility was not operating within its newly approved safety envelope. It was also discovered that the quantity of material present in Building 334 exceeded the amount used in the accident analysis.

Sitewide Issue 4: Implementation of Matrix Management

Implementation of the matrix management style at LLNL has contributed to some miscommunication of ES&H responsibilities among some directorates, less than full integration of sitewide ES&H programs, and lack of adequate control and accountability of subcontractors.

In multi-user facilities, the presence of several operations and maintenance groups has led to problems. Examples of situations which reduced the margin of safety include:

- Implementation of technical safety requirements for Building 332 was adversely impacted in March 1995 when facility management failed to assure that matrixed support personnel were prepared to satisfy new requirements. As a result, several actions were taken: Memoranda of Understanding with Plant Engineering and Hazards Control were established to more clearly define responsibilities; facility-specific procedures were prepared for maintenance support; and training was provided to matrixed personnel on the SARs and technical safety requirements.

- Currently, communications regarding work assignments, job location, and required safety training do not ensure that all matrixed personnel receive appropriate facility-specific training.

- Building 612-4 receives all forms of hazardous waste, yet it does not have a sprinkler system. This deficiency has been consistently identified in this area and its precursor buildings for over ten years. Funds under the General Plant Project Program has been available, yet due to ineffective management, the sprinkler upgrade has never been completed. LLNL disagrees with OAK that sprinklers are necessary.

Lack of sitewide integration of the electrical safety program is another concern. There have been numerous incidents involving electrical safety program at LLNL, as evidenced by several entries in the Occurrence Reporting and Processing System. Site ES&H personnel believe that electrical shock is one of the most likely hazards that could result in a fatality or a serious injury to workers at LLNL.

Subcontractors working on site at LLNL have a history of not following site ES&H rules and thereby endangering themselves. Numerous lockout/tagout violations and sloppy maintenance are attributed to subcontractors. In 1994, an incident involving a subcontractor and a mobile crane boom caused $28,000 in damages and could have severely injured subcontractor personnel. LLNL requires its subcontractors to comply with ES&H requirements, performs inspections, and has held them accountable for safety performance.

Sitewide Issue 5: New Explosive Waste Treatment Facility

DOE and LLNL have not yet obtained a permit from the State of California for a new explosive waste treatment facility at Site 300.

Under the Resource Conservation Recovery Act (RCRA) of 1992, states are responsible for issuing permits for waste treatment facilities. DOE and LLNL applied for an explosive waste treatment permit in 1991. In November 1992, explosive waste treatment by burning at Site 300 was terminated due to the lack of a permit. In September 1993, DOE and LLNL negotiated an agreement with the State of California to burn HE in the old explosive waste treatment facility. Application for a new

waste treatment facility permit was resubmitted in May 1994. The state plans to combine the two permits and a third unrelated permit. LLNL has issued a contract with a commercial treatment facility as an interim measure.

Sitewide Issue 6: Aging Facilities

Deteriorating facility conditions at many older facilities at LLNL negatively impact ES&H safety programs. Strategic planning weaknesses have also prevented key maintenance activities from being accomplished and final disposition plans from being formalized.

Many facilities at LLNL date back to the 1950s and 1960s. As a result of several years of underfunding maintenance projects, many of the older facilities do not meet current accepted safety and health standards. For example:

- The deteriorating condition of Building 151's roof requires workers to put coverings over computers when it rains to prevent the computers from getting wet and posing an electrical hazard. LLNL has placed a high priority on roof replacement but is awaiting funds.

- Building 222 had a $7 million dollar maintenance backlog as of April 1994. LLNL is not updating a maintenance information or spending money to address the backlog. The current plan is to vacate Building 222 in early 1997; however, there is no disposition plan for Building 222 once it is vacated, nor has there been any characterization of suspected hazardous or mixed waste that will have to be remediated during D&D. If Building 222 is left unoccupied or a long period of time, the contents of the building, which include asbestos and unknown residual amounts of mixed/hazardous waste, are vulnerable to dispersal and migration. LLNL believes that it has addressed this issue to the extent it can and is awaiting DOE funding and guidance on disposition of this facility.

Building 826 is an explosive processing facility. This facility is used for formulating

3.2 SITEWIDE ISSUE STATUS

Table 1 characterizes sitewide issues in terms of an issue statement, primary concerns, site activities, and progress evaluation.

4.0 KEY FACILITIES

4.1 FACILITY MISSION

Site 300 Environmental Testing Facilities

These facilities support HE safety performance testing and characterization. There are a number of diverse safety tests facilities that support HE shock, thermal, and impact testing.

Building 834 is a thermal test facility for long-term thermal exposure experiments.

Building 836 is a dynamic test facility used to conduct vibration and shock testing.

The Building 854 complex houses dynamic test equipment to conduct vibration and shock testing. This facility is currently inactive.

Building 858 provides impact shock testing using a 100 ft drop tower. This building is rarely used.

Site 300 Chemical Processing Facilities

These facilities consist of laboratories for processing energetic materials and components. Three types of HE are formulated at Site 300: plastic bonded, extrusion cast explosive, and paste.

Building 825 is an explosive processing facility.

small quantities of explosives and formulation work on extrudable (paste or cured) explosives.

The Building 827 complex is the primary facility used for HE formulation. The complex consists of five structures:

- 827A contains the control room used to direct remote HE operations.
- 827B contains rooms for a conventional machine shop and one to perform small-scale inert assembly work.
- 827C is used for large-scale explosive formulation and for mixing, paste extrusion, and filtering of HE.
- 827D is used for scaling up material synthesized at that HE activity and for mixing and casting lower viscosity extrudable explosives.
- 827E is used for pressing, melting, and casting HE.

Heavy Element Facility, Building 251

This facility contains offices, laboratories, and equipment (including glove boxes) formerly associated with heavy element research. It provides research areas formerly used for conducting experiments in radiochemistry using transuranic elements.

The facility was built in seven increments, the first becoming operational in 1956 and the last being completed in 1980. Building 251 capabilities formerly included preparation of tracer sets associated with the underground testing of nuclear devices, and basic research devoted to better understanding the chemical and nuclear behavior of the transuranic elements.

Table 1. Sitewide Issues

ISSUE	PRIMARY CONCERNS	SITE ACTIVITIES	PROGRESS EVALUATION
1. Workers are potentially at risk of exposure to plutonium contamination and unnecessary radiological exposure	Plutonium storage operations pose potential health hazard that could adversely affect workers. Criticality concerns also exist.	• Repackaging of bulged containers • All containers of plutonium ash are stored in vented filtered overpacks in the vault • Characterization of the packages is under way • Compensatory measures are in place pending completion of the characterization process (01/97)	220 of 558 requiring characterization have been completed **(updated 5/96)**
2. DOE line management is less than effective due to a lack of coordination among programs, and the lack of emphasis on the Facility Representative program.	While the reorganization increased emphasis on the Facility Representative program , the impact on ES&H matters is not yet clear.	• Reorganization of ES&H functions • Reassignment of Facility Representatives	Not evaluated **(updated 5/96)**
3. Authorization bases are not complete and safety envelopes are not always fully maintained.	Facilities might operate outside their safety envelopes, and risks may not be properly identified.	• OAK implemented a contract performance measure.	LLNL is reducing its backlog of safety authorization deficiencies. **(updated5/96)**
4. LLNL matrix management has resulted in some examples of poor integration of work control and degradation of worker safety	Program effectiveness is decreased as a result of the not fully integrated management system. Subcontractor employees may endanger themselves, other workers, the environment, or the public due to their lack of ES&H knowledge and procedures.	• Facility-specific surveillance procedures have been developed for Building 332, and matrixed support has been trained.	Not evaluated **(updated 5/96)**
5. Construction of a planned Explosive Waste Treatment Facility has been inordinately delayed due to the state permitting process.	LLNL's effectiveness in storage and disposal of explosive waste is limited without the new burn and waste treatment facility.	• Contracts have been executed with two commercial vendors to provide interim support. • LLNL is working with the California Department of Toxic Substance Control to facilitate review of permit application.	DOE anticipates that the state will offer a public comment opportunity in August 1996. **(updated 5/96)**
6. Deteriorating facilities reduce the margin of safety afforded workers.	Poorly maintained facilities present higher hazards to workers, public, and environment. No plan in is place to D&D older contaminated buildings	Facilities are placed in standby while awaiting Cognizant Secretarial Office funding for new projects or Environmental Management funding for D&D.	Not evaluated **(updated 5/96)**

The facility is in standby mode to clean out glove boxes and waste. Most of the heavy elements are now stored in underground storage vaults, in Mosler safes, or in Department of Transportation Type B (6M) containers in the hot cells. Among the items stored in the facility are the world's supply of some of the rare actinide isotopes. The heavy elements in storage and the contaminated equipment will remain in the facility or shipped to an offsite transuranic waste storage facility. It is expected that the facility will go into cold standby by October 1996. (In cold standby all radioactive materials are in storage. These materials may be processed for transfer out of the facility. Contaminated equipment remains in the facility. Surveillance and maintenance are the only ongoing activities.) Eventually the facility will go to EM-60 for eventual decontamination and decommissioning.

Chemistry Facility Building 132 N

Building 132N is a new chemistry facility that is being constructed to replace Building 222. It will provide the Chemistry and Materials Sciences Department with operating wet chemistry laboratories to support a variety of research projects and chemical analysis activities. This building will be classified as non-nuclear will be ready for occupancy in January 1997.

Building 166

This non-nuclear facility provides general research capabilities. The building has a high bay with small amounts of heavy elements associated with the U-AVLIS project. The rest of the building houses a laser laboratory and a semiconductor development laboratory.

Superblock, Buildings 331, 332, and 334

The Superblock area is a special-access area provided constant protection.

Building 331 (tritium facility) is currently in a transition state until a new mission for this building is identified. The facility is currently proposing that it be designated a Defense Programs "User" facility. The maximum inventory of tritium remaining in the facility is less than 1.5 grams (15 kCi), principally in contaminated equipment.

Building 332 (plutonium facility) began operations in 1961. The facility's original mission was to support the nation's nuclear weapons program through research into the physical, metallurgical, and chemical properties of plutonium. In 1977, the mission expanded to include fabrication, testing, and assembly of plutonium device parts in support of the LLNL nuclear testing program. Currently, Building 332 develops plutonium processing technologies, reduces LLNL's excess plutonium and fissile uranium inventories, and functions as the central repository for plutonium and fissionable uranium. More specifically, it provides laboratories and equipment for working with plutonium, uranium, and other fissile materials in a variety of operations, including machining, cutting, casting, and isotope separation.

Building 334 (hardened engineering test building) conducts intrinsic radiation measurements and physical tests on non-explosive nuclear weapon components. The facility is authorized to handle up to 12 kg of encapsulated material.

321 Complex

Most of the 321 Complex was built in the late 1950s and supports general site machining requirements. The areas that support the nuclear weapons program (i.e., 321C numerical controls and assembly areas) are not as busy as they once were due to cutbacks. To maintain adequate work, LLNL is bringing in Cooperative Research and Development Agreement (CRADA). There are no current plans to shut down the 321 Complex. Over the years, additional capabilities such as radiography, laser welding, and plating have been added. Building 321 is the primary building in the 321

Complex, and is split into three wings:

- Wing 321A provides general large scale machining.
- Wing 321B provides machine tool services, including inspecting, fixing, modifying, and upgrading large machine tools.
- Wing 321C machines parts in support of the nuclear weapons program, supports weapons testing (mostly shut down), and operates lasers for optical alignment Building 322, a plating shop, has 42 chemical vats and 39 rinse water tanks supporting routine plating, etching, and polishing for optical, electronic, and mechanical components.

Trailer 3203 contains small amounts of chemicals in cabinets to support plating and etching.

Building 327 provides a nondestructive testing capability. Radiography processes are also performed here using accelerators, sealed sources, x-ray equipment, and lasers.

Building 329 houses laser welding in support of the weapons program.

Site 300 - Mechanical Processing Facilities

Site 300 mechanical processing facilities prepare explosive test assemblies. They include:

- Building 805, used for office work, metal machining, and explosives waste handling and storage.
- Building 806, the primary machining area for making complex HE shapes
- Building 807, a backup machining facility that contains a remotely operated lathe
- Building 809, which makes complex HE shapes and is also used for radiographic inspection of HE components
- Building 810, used to assemble HE parts in preparation for testing
- The Building 817 complex, built in the 1960s, which has two operating cells and performs isostatic pressing of HE charges
- Building 823, used as needed, and has a 9 MeV x-ray machine for radiography
- Building 829, a burn facility with 3 open pits and an iron horse to treat waste HE and HE residue (will shut down when Building 845 becomes operational)
- Building 845, an old firing facility that will be modified to become the new explosive waste treatment facility. Several explosive storage magazines will be converted to waste storage to support this process. No work will be done to modify the facility until the State of California approves the permit.

Site 300 Firing Facilities

The Site 300 Firing Facilities are used for "hydrodynamic testing" of HE. The term hydrodynamic testing refers to the fact that when HE are detonated, such high pressures are produced that solid materials (even when not melted) flow like fluids. The firing facilities capture the dynamics of material in motion at ultrahigh speeds using x-ray and electro-optic pictures. Firing tests are run from control bunkers associated with each firing facility. There are observation posts near the firing facilities to spot people, animals, aircraft, and other things that might interfere with testing.

Although the firing facilities continue to be principally used for nuclear weapons research, tests of conventional weapons are also conducted. Facility improvements have focused on adding capabilities to record test data (flash x-ray machines, high speed optical cameras, the gamma ray camera, and multi-beam laser velocimeter. The laboratory expects to construct a contained firing facility at Building 801 in the future.

Building 801, built in the early 1950s, supports explosives tests for the nuclear weapons program. This facility has a flash x-ray for recording HE detonation tests. This one-of-a-kind machine produces high-resolution x-ray pictures of high density objects. It can penetrate more than a foot of steel, and its digital imaging camera can record the material structure of an explosively driven implosion.

Building 812 is a backup firing facility that is also used for storage.

Building 851 supports explosives tests, including most of the experiments for the advanced conventional weapons program. It has the same type of diagnostic capabilities as Building 801, and includes the new multi-beam velocity systems.

Building 850 is a backup firing facility **also** used for camera repair.

Site 300 Materials Management Facilities

The materials management facilities have overall control of receiving, shipping, storage, and accountability of HE. About 50,000 lbs of HE is stored in Site 300 magazines. Most of this HE is classified as "1.1" (mass detonating high explosive). The major problem with materials management operations is that Site 300 is running out of magazine storage due to siting problems. In addition a good deal of the HE is more than 20 years old and has lost its Department of Transportation shipping classification. Site 300 management is developing a master plan for future siting of magazines and other facilities.

Building 818, a staging and short term storage area, serves as the central point for HE materials management and site delivery.

Building 824 is currently used for storing medium caliber munitions.

Building 857 is used as a storage magazine.

Superblock Support Facilities (Buildings 231, 233, 239)

Buildings 23 vaults stores plutonium sources (among other things). Building 239, a non-nuclear facility, is used to conduct radiography in support of plutonium operations.

Building 231 conducts vault operations limited to shipping, receiving, inspecting, weighing, packaging, and storing of controlled materials and sealed sources, and onsite transportation functions. Many of the sealed sources are excess and must be stored and managed in order to retain control of them. Building 231 also has a large industrial area that has a variety of research laboratories, a machine shop, and an assembly bay in support of the nuclear weapons program. Some of the research activities include chemical vapor deposition, advanced plastics work, and composites development.

The Building 233 vault contains sealed sources, precious metals, and classified materials. This vault is also used to store some beryllium in sealed drums. The fenced-in Canopy Area is a temporary storage area for high curie transuranic waste in 55 gallon drums that exceed the levels allowable for Building 625.

There are two primary support buildings:

- Building 232 is a fenced, covered support building that stores hazardous materials (non-classified storage).
- Building 343 houses pressure testing of containers to certify them for shipping special nuclear materials

Chemistry and Material Science Facilities (Buildings 222, 151, 235, 241)

The chemistry and materials science facilities at LLNL are engaged in a wide range of research and development projects. Currently many activities, buildings, and laboratories are being consolidated due to shrinking budgets.

Building 151 is involved with isotopic sciences studies.

Building 222 primarily operates laboratories involved in a variety of research projects and chemical analysis activities. There are 75 laboratories and 97 offices in this facility. It is anticipated that Building 222 will be vacated in early 1997: however, final disposition of this facility has not been determined.

Building 235 contains electron beam laboratories, wet chemistry laboratories, hoods for metallography, and administrative offices. There is a 4 MeV accelerator in this facility for ion implantation and a number of small lasers.

Building 241 houses a wide variety of activities associated with materials science research. Activities include ceramics development, x-ray tomography, x-ray diffraction, and electrochemistry studies (corrosion).

High Explosives Applications Facility (Building 191)

The High Explosives Applications Facility (HEAF) is a non-nuclear facility for the research, development, and testing of energetic materials. HEAF was built to enhance the capability of DOE to develop high explosives with greater performance, less sensitivity, and engineering characteristics that can be tuned to each application. It was designed to house under one roof everything needed to develop and test explosives, their initiation systems, and their applications.

HEAF has a variety of explosive laboratories and work areas; an explosives shipping, receiving, and storage; and its own machine and electronic shops. High explosives ranging in size from gram quantities to 10 kg can be detonated in specially designed firing tanks for containment. HEAF also has a 4-inch gun used in conjunction with a firing tank for high velocity impact experiments on energetic materials. Detonation and impact experiments are supported by state-of-the-art diagnostic equipment.

HEAF has a variety of laboratories for synthesis, formulation, and small-scale sensitivity and safety testing of experimental energetic materials.

Uranium-Atomic Vapor Laser Isotope Separation (U-AVLIS) Facility

Building 490, built in the mid-1980s, is the primary Uranium-Atomic Vapor Laser Isotope Separation (U-AVLIS) facility. The program conducts research in techniques for laser isotope enrichment of uranium and other elements.

The U-AVLIS program is currently being funded by the United States Enrichment Corporation (USEC), under a memorandum of agreement with DOE. As part of the agreement, DOE will provide ES&H oversight of the facility. USEC is currently a government owned corporation but legislation is before Congress to privatize the corporation.

Waste Management Facilities (514 Area, 612 Complex, and Building 693)

The 514 Area serves as the liquid treatment facility for LLNL. Aqueous liquid and radiological waste are treated in this area by chemical precipitation and subsequent filtration. The liquid treatment facility treats approximately 50,000 gallons of liquid waste each year. The two buildings located in this area are used to perform the following functions:

Building 513 is used to store and repackage depleted uranium in drums.

Building 514 houses the equipment for the silver recovery and waste water filtration.

The 612 Complex is used for packaging, storing, treating, and offsite shipping of radioactive, hazardous, and mixed waste.

Area 612-1B Tent is used for storage of solid mixed waste only (boxes). Liquids, polychlorinated biphenyls (PCBs), and asbestos are not allowed in this area. It is also used for storage of low level and transuranic radioactive waste.

Area 612-1 between the tents is used to store drums (radioactive waste only).

Area 612-2 (Container Storage Unit) is used for storage of solid and liquid hazardous and mixed waste. There is also ignitable radioactive waste in storage, and frozen biological waste. No PCBs covered under the Toxic Substance Control Act (TSCA PCBs) (PCB > 50 ppm) are allowed in this area.

Area 612-3 (Drum/Container Storage Unit) is being used for storage of empty but possibly radioactively contaminated containers.

Area 612-4 (Receiving, Segregation, and Container Storage Unit) is used for storage of liquid, solid, or gaseous hazardous, low level radioactive, and mixed waste. No TSCA PCBs (PCB > 50 ppm) or asbestos is allowed in this area.

Area 612-5 (Container Storage Unit) is used to store low level radioactive, classified, and solid mixed waste boxes. Liquids, PCBs, and asbestos are not allowed in this area.

Area 612-5 (Outside) is used to store packed 7A boxes with solid radioactive material only. Liquids, PCBs, and asbestos are not allowed in this area.

Area 612-PT (Portable Tank Storage Unit) has two bermed areas used to separately store 330 gallon tuff tanks and 660 gallon tanks and smaller.

Building 612-100 is used for storage and consolidation of hazardous waste. It has a high bay for storage of solid, liquid, and gaseous mixed waste and radioactive waste only. No TSCA PCBs (PCB > 50 ppm) or asbestos is allowed in this area. Waste carriers from the generators are unloaded, labeled, and sorted in the high bay.

Building 614 East Cells (Container Storage Unit) is used for storage of solid, liquid, and gaseous hazardous waste. Ignitable, reactive, toxic, and corrosive wastes are grouped by compatibility and appropriately segregated in one of four cells. No TSCA PCBs (PCB > 50 ppm) or asbestos is allowed in this area.

Building 614 West Cells (Container Storage Unit) is used for storage of solid, liquid, and gaseous mixed, hazardous, and radioactive waste only. No TSCA PCBs (PCB > 50 ppm) or asbestos is allowed in this area.

Building 625 (Container Storage Unit) has an

east and west section. Building 625 East is used as a storage facility for transuranic wastes in 55-gallon steel drums (up to 6 curies per drum). Building 625 West is used for storage of TSCA regulated waste, such as PCBs, asbestos.

Building 693 has four cells for chemical waste segregation of radioactive and mixed waste, and mixed TSCA controlled waste. It is enclosed, and also used as a chemical exchange warehouse.

It is expected that the 514 Area, 612 Complex, and Building 693 will continue to support LLNL waste management activities until 1999 completion of the new Decontamination and Waste treatment Facility.

4.2 FACILITY SUMMARY

Table 2 summarizes key facility characteristics, including status, hazard classification, worst case design basis accident, and principal hazards and vulnerabilities.

5.0 PERFORMANCE MEASURES

This section is under development and will be presented in future versions of the site profile.

Table 2. Facility Summary

FACILITY NAME	STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPLE HAZARDS AND VULNERABILITIES
Site 300 Environmental Testing	Bldgs. 834 and 836 operational Bldgs. 854 and 858, inactive	Facility Category- Explosives The 1984 safety analysis report (SAR) does not adequately describe the safety envelope and was not approve by DOE. Work is progressing slowly on a revision.	Detonation during preparation for dynamic testing. Significant facility damage and possible serious injury or death to facility workers	**Hazards:** High explosives (HE) and high pressures. **Vulnerabilities:** Performing operations that add energy to HE.
Site 300 Chemical Processing Facility	Operational	Facility Category- Explosives The 1988 SAR does not adequately describe the safety envelope and has not been approved by DOE. LLNL is drafting a revision.	Detonation during mechanical pressing. Significant facility damage.	**Hazards:** High explosives; industrial; and chemical. Vulnerabilities:; Performing operations that add energy to HE.
Heavy Element Facility- Building 251	Operations suspending -- cleanup ongoing	Facility Category - III SAR approved Dec 1994 and SAR revision for standby condition under development.	Earthquake followed by fire that releases Am-241, resulting in 3 rem committed effective dose equivalent (CEDE) at 100 meters on site and 0.014 rem CEDE at the near site boundary	**Hazards:** Radiation and industrial. **Vulnerabilities:** Storage of heavy elements and cleanup of radioactive solutions and waste; uncharacterized radioactive solutions.
Chemistry Facility- Building 132N	To be operational by Jan 1997	Facility Category -Low hazard Out of date preliminary safety assessment document	None yet.	**Hazards:** Construction activity Vulnerabilities: Worker exposure to construction hazards.
Building 166	Operational	Facility Category -Moderate safety assessment document	Release of Arsine gas.	**Hazards:** Toxic gas; acid baths; chemicals; lasers; radioactive elements; industrial. **Vulnerabilities:** Primarily to workers from heavy metals in the glove box and hazardous chemicals used in semiconductor development.

Table 2 (cont'd). Facility Summary

FACILITY NAME	STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPAL HAZARDS AND VULNERABILITIES
Superblock-Buildings 331, 332, and 334.	Bldg. 331 is transitional Bldg. 332 is operational Bldg. 334 is operational	331-Facility Category 3, SAR approved 1993; 332-Facility Category 2, SAR approved by OAK 1995 334 - Facility Category 3, 1996 proposed draft SAR down grades facility to Low Hazard Radiological.	331 - Gas release from earthquake. Approximately 4 mrem CEDE at site boundary. 332 - Waste drum puncture and fire. Approximately 4.6 rem CEDE maximum offsite dose. 334 - Breach of container and slow oxidation. Approximately 0.45 mrem CEDE at the site boundary.	**Hazards**: External radiation exposure; contamination, inhalation, and ingestion; potential criticality, industrial; potential plutonium release; use of chlorine and hydrochloric acid. **Vulnerabilities:** plutonium stored that contains unknown material conditions and packaging configurations;(radiolysis and pressure buildup, corrosive potentials, chemically reactive,; difficult to contain); seismic concerns; (systems failure, structural collapse, breach of containers); and excess plutonium; combined with an absence of a disposition plan.
321 Complex	Operational	Facility Classification Moderate, preliminary hazard assessment (PHA).	Fire resulting in beryllium release. Site boundary concentrations less than emergency response planning guidance.	**Hazards:** Industrial; electrical; cleaning solvents; depleted uranium and beryllium; class 4 lasers; radiation; and chemical solvents. **Vulnerabilities:** Primary vulnerabilities are hazards to workers posed by above hazards and building deterioration.
Site 300 Mechanical Processing Facilities	Operational	Facility Cat Explosive, No facility SARs: one is being prepared for the overall operation. Justification for continued operations for 829; preliminary SAR for proposed explosive waste treatment facility	Detonation during machining. Results in significant damage to work bays. Deflagration to detonation during burning results in major wild fires and injury to firefighters. Initiation during assembly results in up to 6 fatalities on site.	**Hazards:** Potential for detonation while handling, pressing, machining, and assembling HE; general industrial hazards; chemical; and radiography. **Vulnerabilities:** Adding energy during processing, and potential for wildfires from explosive burning.
Site 300 Firing Facilities	Operational	Facility Cat Explosives The 1986 SAR for the firing bunkers did not address safety. A new SAR is near completion	Detonation during final setup of a shot or investigation of a misfire results in fatalities and serious injuries to people at the firing table.	**Hazards:** Explosives; radiation; lasers; industrial; debris containing depleted uranium and beryllium. **Vulnerabilities**: Planned detonation testing results in low level wastes and potential for loud noise and grass fires spreading offsite.

Table 2 (cont'd). Facility Summary

FACILITY NAME	STATUS	HAZARD CLASSIFICATION/ AUTHORIZATION BASIS	WORST CASE DESIGN BASIS ACCIDENT	PRINCIPAL HAZARDS AND VULNERABILITIES
Site 300 Materials Management Facilities	Operational	Facility Cat Explosive SAR actively under development.	Handling- detonation of the entire shipment results in up to five onsite fatalities and injury to ten collocated workers.	**Hazards:** Storage of large amounts of HE; storage of depleted uranium and beryllium. **Vulnerabilities** : Number of hands-on handling operations.
Superblock Support Facilities	Operational	Facility Category 3 SAR for 231 and 233 in draft. SAR approved for 239	Earthquake results in radioactive material release. Details not available.	**Hazards:** Plutonium (radiation and contamination); other radioactive elements; chemical; electrical; general industrial; toxic materials; and hydrogen. **Vulnerabilities:** Packaging configurations of sealed plutonium sources; degradation, rupture or damage to packaging could spread plutonium and expose workers.
Chemistry and Materials Science Facilities	Bldg. 151 is operational; Bldg. 222 use until Jan 1997; Bldgs. 235 and 241 operational	Facility Classification: Low	Chemical/gas release within the laboratory results in injury to the researcher.	**Hazards:** Chemicals; radioactive isotopes; high pressure; electricity; industrial; sulfur hexaflouride gas; high voltage; photochemicals; high temperatures; **Vulnerabilities:** Age and rapid deterioration of the Building 222; no disposal plan for buildings that contain residual amounts of hazardous or mixed wastes.
High Explosives Applications Facilities-Building 191	Operational	Facility Cat Explosive SAR approved in 1990- revised SAR 1995, DOE approval expected May 1996.	Detonation in 10 kg handling area results in fatalities to people in the work room.	Hazards: **Explosives,** industrial, and chemical. **Vulnerabilities:** Multiple activities with explosives(handling, storage, testing) in a laboratory facility.
U-AVLIS	Operational	Facility Category 3 BIO for safety authorization approved by DOE Oakland	Fire resulting in dispersal of uranium in building 493 results in 12 mrem CEDE to workers on the site and 7 mrem to a person at the site boundary.	**Hazards:** Radiological in nature; electrical; laser; and industrial. **Vulnerabilities:** Worker exposure to radiological or industrial hazards.
Waste Management Facilities	B233 canopy, 514 Area, 612 Complex, and Building 693 are operational	Facility Category 3 nuclear facility Draft SAR is being revisied by LLNL to incorporate DOE concerns.	Earthquake causes building to collapse, falling beam on drum spreads plutonium and americium	**Hazards:** Radioactive carcinogenic, corrosive, flammable, toxic, pyrophoric, and reactive materials that can present physical and health hazards; motor vehicles; cranes; steam heat; mechanical systems; electrical systems; high pressure air and hydraulics; and confined spaces. **Vulnerabilities:** Primarily the large amounts of radioactive, hazardous, and mixed wastes that are stored and handled.